REMARKS

Claims 1, 3-11, 13-21, 23-41 and 43-61 are pending in the application.

Applicants acknowledge and appreciate that the prior 35 U.S.C. 112, 2nd paragraph rejection of claims 1, 3-11, 13-21, 23-41 and 43-61 has been withdrawn.

The rejection of claims 1, 3-11, 13-21, 23-41 and 43-61 under 35 U.S.C. 112, 1st, paragraph has been maintained. In light of the amendments and arguments provided herein, Applicants respectfully traverse this rejection.

Although Applicants respectfully disagree with the Examiner that the term "deposition rate sensors" in the claims is not supported by the Specification, Applicants have made amendments to claims 1, 11, 21, 31, 41, 51, and 61 to address the Examiner's concerns in order to move prosecution forward. Specifically the Applicants have amended claims 1, 11, 21, 31, 41, 51, and 61 to call for modeling the dependence of the deposition rate comprises using sensor data relating to a deposition rate for performing the modeling. Applicants respectfully assert that the Specification clearly discloses sensors that are capable of detecting data relating to the deposition rate and performing a modeling using such data. However, Applicants maintain the position that the condition of the claims before this amendment were also supported by the Specification but have amended the claims, not for patentability issues, but for moving prosecution forward. In light of the amendments to the independent claims, the Examiner's rejection of claims 1, 3-11, 13-21, 23-41, and 42-61 under 35 U.S.C. 112, first paragraph, is now moot and respectfully assert claims 1, 11, 21, 31, 41, 51, and 61 these claims are now allowable.

However, claims 1, 3-11, 13-21, 23-41 and 43-61 have been newly rejected under 35 U.S.C. 112, 2nd paragraph as being indefinite. Applicants respectfully traverse this rejection.

The Examiner asserted that the target and the cathode in ***Turner*** are "essentially one and the same." The Examiner made this assertion in response to Applicant's argument that merely disclosing the age of the cathode does not relate to the target life of the sputter target, as called for by claims of the present invention. To counter this argument, the Examiner suggested that the claims are now indefinite because the Applicants' intended to change the definition the terms of the claims. Applicants respectfully disagree with Examiner's assertions. The Examiner has misunderstood Applicants' argument. The age of the cathode disclosure in ***Turner*** does not anticipate or make obvious the target life of the sputter target, as called for by claims of the present invention. The Examiner suggested that the target and the cathode are the same; however, as exemplified in ***Turner***, the term "cathode" is used differently from the term "target". For example, ***Turner*** discloses that the current drawn from the *cathode* supply 16 is controlled by the computer 14 in response to the power dissipated in the plasma, the cumulative usage of the particular *target*, the pressure and the desired deposition rate. *See*, col. 3, lines 5-10. The cathode supply 16 is a device from which current may be drawn in response to the cumulative usage of a particular target. Therefore, the disclosure of ***Turner*** is contrary to the Examiner's argument that the target and the cathode are essentially the same and that Applicant's use of the terms is indefinite. Applicant's use of the term is readily understood by those skilled in the art having benefit of the present disclosure, and therefore if there is no issue of indefiniteness as to the use of the terms in the claims. The argument that disclosing the age of the cathode does not relate to the target life of the sputter target does not therefore, make the claims indefinite. Accordingly, claims 1, 3-11, 13-21, 23-41, and 43-61 are not indefinite and are allowable.

The Examiner rejected claims 1, 3-11, 13-21, 23-41 and 43-61 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,478,455 ***(Actor)***. Applicants respectfully traverse this rejection.

Applicants respectfully assert that ***Actor*** does not disclose or suggest all of the elements of claim 1 of the present invention. ***Actor*** is directed to calculating a multiplier factor as a function of the age of a collimator sputtering source to adjust a parameter during film deposition. The Examiner relies on the disclosure that a formula is used to compensate for changes in the deposition rate due to erosion of the sputter target. *See*, col. 6, lines 13-33. However, contrary to Examiner's assertion, ***Actor*** simply does not disclose a dependence of the deposition rate on a plasma power and deposition time. The Examiner cites the disclosure in ***Actor*** that relates to increasing the deposition time after processing each wafer, as well as increasing the deposition power after processing each wafer. *See*, col. 6, lines 19-22. However, this does not equate to modeling the dependence of the deposition rate based on the deposition plasma power and the deposition time, as called for by Claim 1 of the present invention. ***Actor*** merely discloses increasing a predetermined scheduled increase in deposition time and deposition power after processing each wafer. This simply does not equate to modeling the dependence of the deposition rate based on the deposition plasma power and the deposition time, as called for by claims of the present invention.

Further, ***Actor*** simply does not disclose that modeling the dependence of the deposition rate being based on the target life of the sputter target. Again, the Examiner relies on the disclosure that using a formula to change the deposition rate due to erosion of sputter target equates to modeling the dependence on the deposition rate based on the target life of the sputter target. *See*, col. 6, lines 29-31. Therefore, this yet is another element that is not taught or

suggested by ***Actor***. Further, the Examiner asserted that ***Actor*** discloses modeling the dependence of the deposition rate comprising using deposition rate sensor data for performing said modeling is also disclosed by ***actor***. This statement in the claim has been amended and now calls for modeling the dependence of the deposition rate comprising using sensor data relating to deposition rate for performing the modeling. ***Actor*** simply does not disclose using any type of sensor data to perform to control the deposition rate. In fact, ***Actor*** simply does not disclose modeling of any type, much less modeling based upon sensor data relating to deposition rate. The Examiner asserted that "if the formula were determined empirically, or through observation, then the deposition rate must be observed somehow and that it would seem inherent that some sort of rate sensor would have been used." *See*, page 9 of the office action dated November 23, 2005. Applicants respectfully assert that it is not inherent that any type of sensor is used by ***Actor***. In fact, the mere mention of deposition rate sensor was dismissed as expensive and unreliable and ***Actor*** actually discourages such use. *See*, col. 2, lines 45-47.

Further, ***Actor*** simply does not disclose utilizing any type of sensor that provides data relating to deposition rate, much less modeling deposition rate based upon such data. Therefore, yet another portion of the claim is not taught, disclosed or suggested by ***Actor***. Hence, all of the elements of claim 1 of the present invention are not taught, disclosed or suggested by ***Actor***. Additionally, independent claims 11, 21, 31, 41, 51, and 61, which have similar elements that call for modeling the dependence of the deposition rate on the plasma power or deposition time based upon the target life, and using the model to modify the deposition processing to approach a desired thickness, are also allowable for at least the reasons cited above. Therefore, in light of at least the above-presented arguments, claims 11, 21, 31, 41, 51, and 61 are also allowable.

Independent claims 1, 11, 21, 31, 41, 51, and 61, are allowable for at least the reasons cited above. Additionally, dependent claims 3-10, 12-20, 23-30, 32-40, 43-50, and 52-60, which depend from independent claims 1, 11, 21, 31, 41, and 51, respectively, are also allowable for at least the reasons cited above.

The Examiner rejected claims 1, 5, 6, 10, 11, 15, 16, 20-21, 25, 26, 30-32, 35, 36, 40-41, 45, 46, 50-52, 55, 56 and 60 under 35 U.S.C. 102(b) as being anticipated by ***Turner***. Applicants respectfully traverse this rejection.

The present invention is directed to modeling the dependence of the deposition rate on plasma power or the deposition time based upon the target life of the sputter target. This is in contrast with ***Turner*** since it does not disclose modeling the deposition rate at all. ***Turner*** discloses a sputtering system, in which the desired deposition rate information is inputted by an operator to calculate the required power (see col. 3, lines 30-34). ***Turner*** discloses that deposition rate sensors are not used to complete a feedback loop, but use the sputtering source itself. ***Turner*** discloses using the sputtering to allow for regulation and correction of a process (col. 3, lines 64-67). However, ***Turner*** does not disclose monitoring the consumption of a sputter target to determine a deposition rate, as called for by claims of the present invention.

Applicants assert that claims 1, 5, 6, 10, 11, 15, 16, 20-21, 25, 26, 30-32, 35, 36, 40-41, 45, 46, 50-52, 55, 56 and 60 are not anticipated by ***Turner***. The claims of the present invention calls for modeling the dependence of the deposition rate, which includes using the deposition sensor data for performing the modeling of the dependence of the deposition rate to a deposition plasma power or a deposition time based upon a target life of the sputter target, which is not disclosed by ***Turner***. The Applicants respectfully assert that ***Turner*** does not disclose or suggest

all of the elements of the claims of the present invention. For example, the Examiner cites column 3, lines 22-32 of ***Turner*** to read upon the element of monitoring the consumption of the sputter target to determine a deposition rate, as called for by claims of the present invention. However, ***Turner*** merely discloses that the deposition rate, the power consumption, and the aging characteristics may be expressed as an empirically obtained function specific to the cathode material. The age of the cathode is expressed in kilowatt hours. *See*, col. 3, lines 23-32. However, this does not relate to consumption of a sputter target to the deposition rate and modeling the dependence on the deposition rate to the target life of the sputter target. Merely disclosing the age of the cathode does not relate to the target life of the sputter target as called for by claims of the present invention.

Further, in the Office Action, the Examiner makes an implication of deposition plasma power and target life from ***Turner***. However, this implication is not supported by neither the Examiner's arguments, nor by the disclosure of ***Turner***. The power consumption disclosed by ***Turner*** generally refers to the power dissipated by the excitation source, which is monitored by examining the current drawn from the cathode and the cathode-anode voltage (*See* col. 1, lines 42-47). ***Turner*** does not disclose modeling the dependence of the deposition rate to a deposition plasma power, and Applicants respectfully assert that the Examiner does not offer evidence to imply the deposition plasma power. Applicants respectfully assert that there is no disclosure or any evidence provided by the Examiner to make such an implication and it would be inappropriate in a rejection under 35 U.S.C. § 102. ***Turner*** discloses that the current drawn from the cathode supply is controlled in response to power dissipated in the plasma, the cumulative usage of the particular target, the pressure and the desired deposition rate. (*See* col. 3, lines 7-11). However, ***Turner*** does not disclose modeling these relationships. Furthermore, ***Turner*** does not

disclose modeling based upon a target life of the sputter target, as called for by claims of the present invention. Therefore, the claims of the present invention are allowable.

Also, the Examiner cites the sputtering source in ***Turner***, which the Examiner assert may be used to provide rate information to illustrate a prior art sensor. However, Applicants respectfully assert that even though ***Turner*** may mention deposition rate monitors that are used to control the excitation source of the plasma discharge and/or the sputtering source, these disclosures are not enough to anticipate or suggest all of the elements of claim 1 of the present invention. For example, as explained in more detail below, ***Turner*** does not disclose modeling the dependence of the deposition rate on plasma power. As another example, ***Turner*** does not disclose modeling any parameters based upon target lives, as called for by claim 1 of the present invention. Although ***Turner*** refers to a deposition monitor, ***Turner*** does not disclose using the deposition monitor to perform any type of modeling. In fact, ***Turner*** discourages the use of the deposition monitor in contrast to the use of deposition sensor data to perform a modeling, as called for by the claims of the present invention. (***Turner*** discloses that a deposition rate sensor is not used to complete the feedback loop of ***Turner***, *See* col. 3, lines 64-65). Therefore, for at least the reasons cite above, all of the elements of claim 1 are not taught, disclosed, or suggested by ***Turner***, and therefore, is allowable.

Turner discloses a sputtering system, in which the desired deposition rate information is inputted by an operator to calculate the required power (*See* col. 3, lines 30-34). ***Turner*** discloses that deposition rate sensors are not used to complete a feedback loop, but use the sputtering source itself. ***Turner*** discloses using the sputtering to allow for regulation and correction of a process (*See* col. 3, lines 64-67). However, ***Turner*** does not disclose monitoring the consumption of a sputter target to determine a deposition rate, as called for by claim 1 of the

present invention. ***Turner*** discloses using the power and duration of the sputtering source operation and calculating a percentage of normalized deposition rate.

Furthermore, claim 1 of the present invention calls for modeling the dependence of the deposition rate on plasma power or the deposition time based upon the target life of the sputter target. This is in contrast with ***Turner*** since it does not disclose modeling the deposition rate at all. The Examiner cites the chart in Figure 1 and implies that it refers to modeling of plasma power. Applicants respectfully disagree with this implication. Figure 1 merely plots a relationship between a percentage of normalized deposition rate and kilowatt-hours of operation of the cathode (*See* Figure 1 and col. 2, lines 35-44). This is provided to illustrate the deterioration of the deposition rate. However, this is not equivalent to modeling the dependence of the deposition on plasma power or the deposition time based upon the target life of the sputter target, since ***Turner*** merely demonstrates the deterioration of the deposition rate after a certain amount of kilowatt-hours.

Additionally, the Examiner equates aging of the cathode in use to "target lives," however, the "target lives" refer to the lives of the sputter targets (*See* col. 2, lines 10-13). Therefore, ***Turner*** does not call for modeling any parameters based upon target lives. Additionally, the Examiner states that the graph in Figure 1 plotting the percentage of normalized deposition rate versus the cathode operation (kilowatt-hours) can be used to imply a modeling of deposition rate to plasma power. However, the Examiner offers neither arguments nor evidence to support such a conclusion, nor is there any evidence in ***Turner*** to support such an assertion. Therefore, ***Turner*** does not disclose the element of modeling the dependence of the deposition on plasma power or the deposition time based upon the target life of the sputter target, or using the model to modify a deposition process, as called for by claim 1 of the present invention.

Turner discloses using the desired rate specified by the operator, and using an equation in a loop to correct the power for the usage of a cathode used in the sputtering system (*See* col. 3, lines 32-38, and the equation on col. 3, line 27). ***Turner*** discloses that the duration of the cathode usage is then incremented, updating the kilowatt hours of use (*See* col. 3, lines 38-42). ***Turner*** corrects the current control of the cathode power supply and continues the loop for controlling the processing of a semiconductor wafer (*See* col. 3, lines 46-49). In contrast to ***Turner***, claim 1 calls for modeling the dependence of the deposition rate on the plasma power or deposition time based upon the target life, and using the model to modify the deposition processing to approach a desired thickness. Therefore, claim 1 is not taught, disclosed, or suggested by ***Turner***. Hence, claim 1 is allowable. Additionally, independent claims 11, 21, 31, 41, 51, and 61, which have similar elements that call for modeling the dependence of the deposition rate on the plasma power or deposition time based upon the target life, and using the model to modify the deposition processing to approach a desired thickness, are also allowable for at least the reasons cited above. Therefore, in light of at least the above-presented arguments, claims 11, 21, 31, 41, 51, and 61 are also allowable.

Independent claims 1, 11, 21, 31, 41, 51, and 61, are allowable for at least the reasons cited above. Additionally, dependent claims 3-10, 12-20, 23-30, 32-40, 43-50, and 52-60, which depend from independent claims 1, 11, 21, 31, 41, and 11, respectively, are also allowable for at least the reasons cited above.

Claims 1, 3-11, 13-21, 23-41 and 43-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over ***Actor*** in view of U.S. Patent No. 5,665,214 ***(Iturralde)***. Applicants respectfully traverse this rejection.

Applicants respectfully assert that the claims of the present invention is not taught, disclosed, or made obvious by ***Actor***, ***Iturralde***, or their combination. The Examiner adds ***Iturralde*** to the disclosure of ***Actor*** to argue obviousness of the element of deposition rate sensor data to the disclosure to read upon claims of the present invention. However, the mere addition of the deposition rate sensor data would not into the disclosure of ***Actor*** would not make obvious all of the elements of claims of the present invention. As described above, various modeling elements of the claims of the present invention are not disclosed, taught or suggested by ***Actor***, and ***Iturralde*** does not make up for this deficit.

Further, those skilled in the art would not combine ***Iturralde*** and ***Actor***. For example, the Examiner uses the disclosure of deposition rate sensor in ***Iturralde*** to combine with ***Actor*** to make obvious the elements of claims of the present invention. However, this particular use of combining the disclosure, *i.e.*, deposition rate sensor data, would not be employed by those skilled in the art since ***Actor*** specifically *teaches away* from the deposition rate sensor data. ***Actor*** specifically suggests that deposition rate sensors are expensive and unreliable and have not gained wide spread commercial acceptance. *See*, col. 2, lines 45-47. Therefore, those skilled in the art would be taught away from employing the disclosure of ***Iturralde*** upon our reading of ***Actor***. Therefore, those skilled in the art would not be motivated to combine ***Actor*** and ***Iturralde*** to make obvious all elements of claims of the present invention. In fact, those reading ***Actor*** and ***Iturralde*** would be directed to not use the deposition rate sensor data of ***Iturralde*** when employing the concepts of ***Actor***. Additionally, as described above, even if ***Actor*** and ***Iturralde*** were to be combined as described above, all of the elements of the claims of the present invention (*e.g.*, the modeling) would not be taught or made obvious. Therefore, the Examiner

has failed to prove a *prima facia* case of obviousness of claims 1, 3-11, 13-21, 23-41, and 43-61. Accordingly, claims 1, 3-11, 13-21, 23-41, and 43-61 on the present invention are allowable.

The Examiner rejected claims 3, 4, 7, 8, 13, 14, 17, 18, 23, 24, 27, 28, 33, 34, 37, 38, 43, 44, 47, 48, 53, 54, 57, 58 and 61 under 35 U.S.C. 103(a) as being unpatentable over ***Turner*** in view of U.S. Patent No. 6,217,720 ***(Sullivan)***. Applicants respectfully traverse this rejection.

The Examiner does not establish a *prima facie* case of obviousness of claims 3, 4, 7, 8, 13, 14, 17, 18, 23, 24, 27, 28, 33, 34, 37, 38, 43, 44, 47, 48, 53, 54, 57, 58, and 61, at least because the prior art references (***Turner*** and ***Sullivan***) when combined do not teach or suggest all of the claims limitations. Accordingly, the Examiner did not meet the legal standards to reject the claims 3, 4, 7, 8, 13, 14, 17, 18, 23, 24, 27, 28, 33, 34, 37, 38, 43, 44, 47, 48, 53, 54, 57, 58, and 61 under 35 U.S.C. § 103(a).

The combination of ***Turner*** and ***Sullivan*** does not disclose, suggest, or make obvious all of the elements of claims 3, 4, 7, 8, 13, 14, 17, 18, 23, 24, 27, 28, 33, 34, 37, 38, 43, 44, 47, 48, 53, 54, 57, 58, and 61. The Examiner stated that the elements relating to the dependence of the deposition rate on the deposition time or inverting the deposition rate model to determine the deposition time is not disclosed by ***Turner,*** and uses ***Sullivan*** to provide such elements. However, as described above, ***Turner*** does not disclose methods and/or apparatus for modeling the dependence of the deposition rate on the plasma power or deposition time based upon the target life, and using the model to modify the deposition processing to approach a desired thickness, which are called for by claims 3, 4, 7, 8, 13, 14, 17, 18, 23, 24, 27, 28, 33, 34, 37, 38, 43, 44, 47, 48, 53, 54, 57, 58, and 61 by virtue of their respective dependencies. Therefore, adding the disclosure from ***Sullivan*** would not make-up the deficit of ***Turner***.

Sullivan discloses a multi-layer sputtering method in which a controller calculates a sputtering time required for the deposition of a specified layer thickness (*See* col. 7, lines 54-57). ***Sullivan*** discloses a theoretical model that models deposited layer. However, ***Sullivan*** does not disclose modeling the dependence of deposition rate to deposition time. ***Sullivan*** adjusts the layer thickness in the theoretical model (*See* col. 7, lines 65-67). The Examiner states that, the fact that determining a deposition time requires a certain deposition rate equates to modeling a dependence of deposition rate on the deposition time. Applicants respectfully disagree. No evidence or argument that would support such a conclusion is provided. ***Sullivan*** is directed towards calculating sputtering time for deposition of specified layer thickness, deposition rates are not calculated in this context. Additionally, ***Sullivan*** does not disclose inverting the deposition rate model to determine the deposition time to reach a deposition rate. Therefore, for at least the reasons cited above, adding the disclosure of ***Sullivan*** to the disclosure of ***Turner***, would not provide all of the elements of claims 3, 4, 7, 8, 13, 14, 17, 18, 23, 24, 27, 28, 33, 34, 37, 38, 43, 44, 47, 48, 53, 54, 57, 58 and 61. Therefore, in light of at least the above presented arguments, claims 3, 4, 7, 8, 13, 14, 17, 18, 23, 24, 27, 28, 33, 34, 37, 38, 43, 44, 47, 48, 53, 54, 57, 58 and 61 are allowable.

The Examiner rejected claims 9, 19, 29, 39, and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over ***Turner*** as applied to claims 1, 2, 11, 12, 21, 22, 31, 32, 41, 42, 51 and 52. Applicants respectfully traverse this rejection.

Applicants respectfully assert that the Examiner did not meet the legal standards to reject the claims of the present invention under 35 U.S.C. § 103(a), including the fact that the prior art reference (***Turner***) does not teach or suggest all the claim limitations of claims 9, 19, 29, 39, and

59 of the present invention. The prior art reference (***Turner***) does not teach or suggest all the claim limitations of claims 9, 19, 29, 39, and 59. Additionally, the Examiner provided no evidence to support a contention of some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference. Therefore, the Examiner does not establish a *prima facie* case of obviousness of claims 9, 19, 29, 39, and 59 of the present invention.

In light of the arguments provided herein, Applicants respectfully assert that ***Turner*** does not disclose methods and/or apparatus for modeling the dependence of the deposition rate on the plasma power or deposition time based upon the target life using deposition sensor rate data, and using the model to modify the deposition processing to approach a desired thickness, which are called for by claims 9, 19, 29, 39, and 59. The Examiner uses obviousness arguments to provide the element of modeling deposition rate and power using curve-fitting techniques. However, Applicants respectfully assert that the Examiner does not provide any evidence to support such an assertion. Furthermore, even if, *arguendo*, the element of modeling deposition rate and power using curve-fitting techniques were added to the disclosure of ***Turner***, the deficit of ***Turner*** would not be compensated for since ***Turner*** does not disclose modeling the dependence of the deposition rate on the plasma power or deposition time based upon the target life using the deposition sensor rate data, and using the model to modify the deposition processing to approach a desired thickness, which are called for by claims 9, 19, 29, 39, and 59. Therefore, claims 9, 19, 29, 39, and 59 are allowable for at least the reasons cited above.

The Examiner objected to claims 4, 6, 10, 14, 16, 20, 24, 26, 30, 44, 46 and 50, due to the claims being dependent on a rejected claim. However, in light of the arguments and amendments presented herein, the claims from which dependent claims 4, 6, 10, 14, 16, 20, 24, 26, 30, 44, 46 and 50 depend are now allowable. Accordingly, the objections to claims 4, 6, 10, 14, 16, 20, 24, 26, 30, 44, 46 and 50 are now moot and therefore, claims 4, 6, 10, 14, 16, 20, 24, 26, 30, 44, 46 and 50 are also allowable.

In light of the arguments presented above, Applicants respectfully assert that claims 1, 3-11, 13-21, 23-41 and 43-61 are allowable. In light of the arguments presented above, a Notice of Allowance is respectfully solicited.

If for any reason the Examiner finds the application other than in condition for allowance, **the Examiner is requested to call the undersigned attorney at the Houston, Texas telephone number (713) 934-4069** to discuss the steps necessary for placing the application in condition for allowance.

Please date stamp and return the enclosed postcard to evidence receipt of this document.

Respectfully submitted,

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